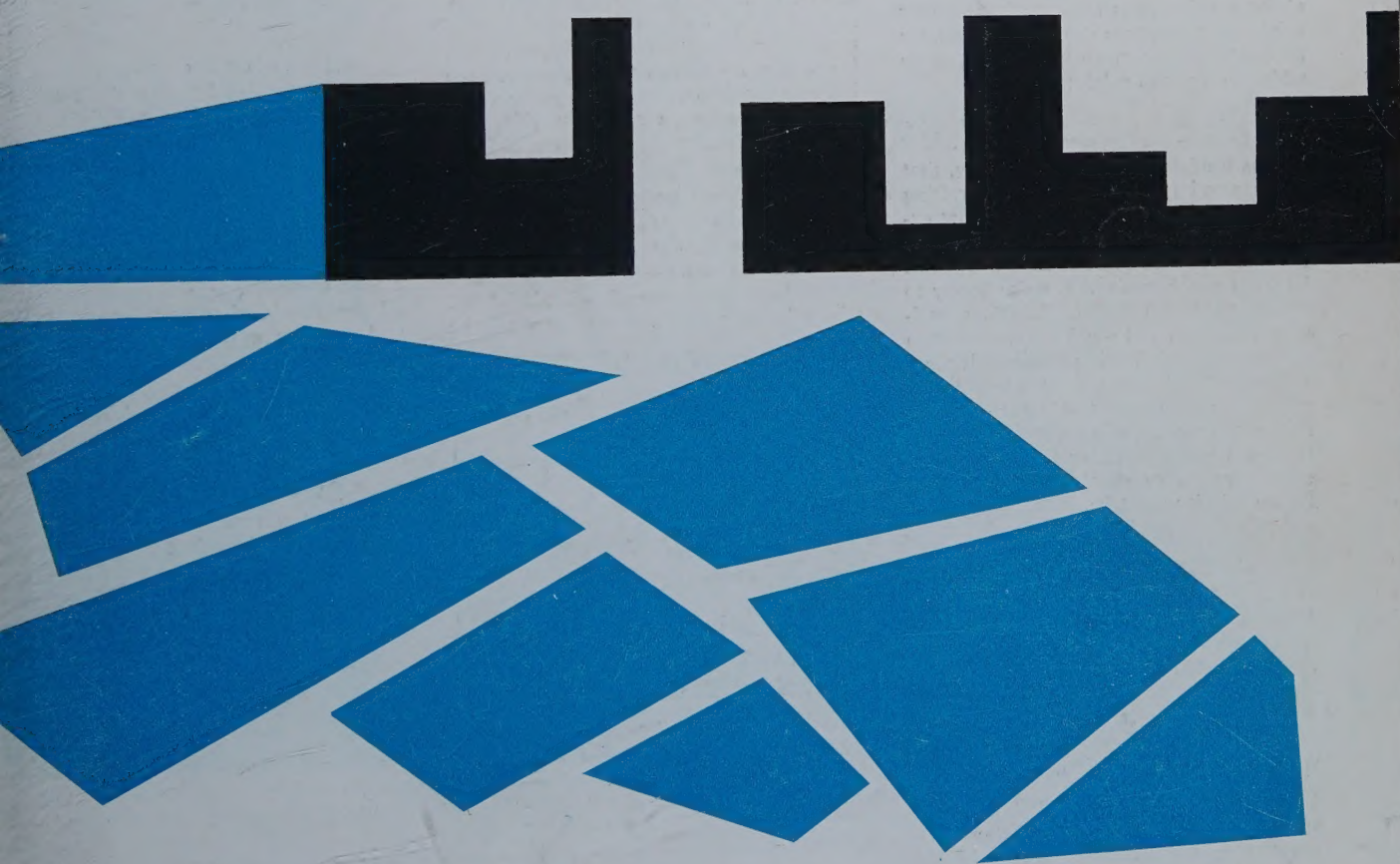


# GRAPHIC SCIENCE



*Mapmaking*

*JANUARY 1961*

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# Some Ideas



for your file of practical information on  
drafting and reproduction from

**KEUFFEL & ESSER CO.**

Six years ago, K&E introduced the very first polyester-base drafting film—a special-purpose medium featuring extreme dimensional stability. Experience with that film indicated that a definite need also existed for a *general-purpose* drafting film, if one could be perfected. About two and a half years ago we succeeded, introducing **HERCULENE®** Drafting Film—the first polyester-base medium for general drafting to meet professional standards. Many recognized its value immediately, stocked up on **HERCULENE**, and have used it happily ever since. Others—a bit more “canny” about adopting a relatively untried medium—deferred decision, saying “see us in a year or so.” Still others—having tried one or more of the other films marketed immediately after **HERCULENE**—seemed permanently disenchanted with *all* film based media. What with the passage of time and much favorable ado about drafting films in general, we rather think that those once stung may now have adopted a more congenial attitude—so we address ourselves solely:

## To fence-sitters everywhere...

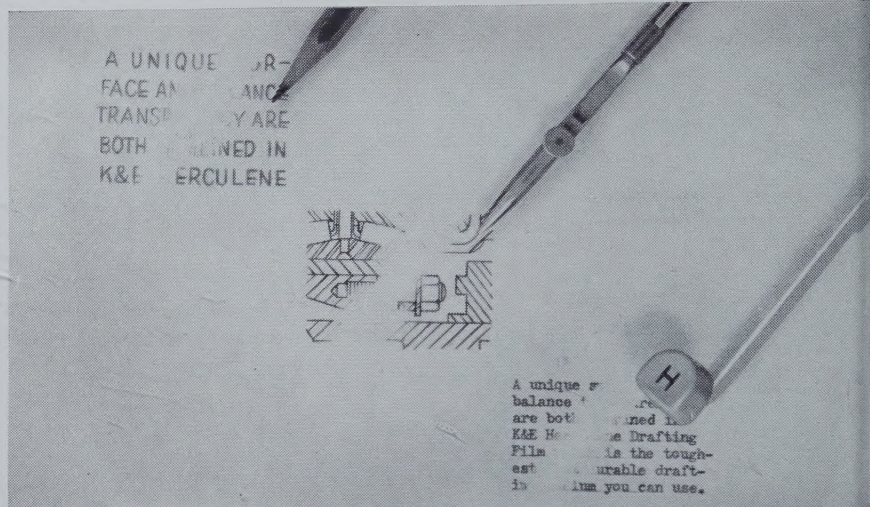
Just as we felt in '58, we feel today, that film has an important place in the drafting room. The only difference now is that experience has *proved* it so. Since 1958, the number of **HERCULENE** users has grown by leaps and bounds. All, we're happy to say, have found **HERCULENE** a welcome, efficient, and *much needed* addition to their stock of drafting media. It is these **HERCULENE** users who have written the record. Their many and rigorous tests, their months of experience, their numerous successes and continuing satisfaction are convincing evidence that **HERCULENE** is all we said it would be.

## Why all the fuss about **HERCULENE**?...

**HERCULENE** combines practically all the qualities of a perfect drafting medium. An excellent product when introduced, it's even closer to perfection today. Working with major film users, K&E specialists have refined **HERCULENE** in many subtle ways since its introduction.

Unlike cloth or paper, **HERCULENE** is virtually indestructible. No matter how roughly or frequently a **HERCULENE** tracing is handled, it will never crack, wrinkle or fade. Absolutely waterproof, a **HERCULENE** drawing can never be permeated and ruined by moisture. Filed away, **HERCULENE** will last indefinitely. And **HERCULENE** has body, too, making it far easier to handle and file, and to keep flat on the drawing board.

Most of the refinements made in **HERCULENE** since 1958 have concerned its engi-



neered drafting surface. **HERCULENE**'s surface “take” for pencil, ink and typing is now better than ever. Erasability, of course, is excellent for all three. Contrast has been built up for sharper definition of line, too, yet all the transparency necessary for fast, clear reproductions has been maintained.

## Two big bonuses, too...

A significant chapter in the **HERCULENE** story has been the development of a waterproof writing mate—the Duralar plastic pencil. Drawings made on **HERCULENE** with this waterproof pencil can actually be



washed in soap and water. Even gray, grimy “unreproducible” drawings can be washed spotless with this new technique. Many firms now use the **HERCULENE**/

Duralar team exclusively... and are realizing undreamt-of savings in costly re-draws.

Some firms, of course, by virtue of smaller work volumes and “cleaner” or less frequent handling, will have little need for this new wash technique. Of particular interest here is another K&E exclusive recently introduced—the amazing Ruwe pencil. The Ruwe pencil will not withstand washing, but in every other respect, this new pencil is *graphite-plus*. Although of plastic composition, the Ruwe pencil has all the “fine” feel of graphite, erases well and deposits a sharp, dense black line. The big bonus: Ruwe pencil lines are *virtually smudge-proof*. Rendered on **HERCULENE**'s engineered drafting surface, they actually resist smudging better than graphite on regular paper!

## We leave it to you...

The best test remains the one you make for yourself. We've just completed a new brochure, titled “A Report on the Growing Acceptance of Polyester Film.” It is detailed most of what we have learned about **HERCULENE** and its use since 1958—including tests you can make to assess its every property. We'd like you to have a copy of this new brochure—plus a sample sheet of **HERCULENE**, a Duralar pencil, and a Ruwe pencil—for your own private testing. To get these free samples simply fill out and mail the coupon below.

**KEUFFEL & ESSER CO., Dept. GS-1, Hoboken, N. J.**

Gentlemen:

Please send me your new brochure, titled “A Report on the Growing Acceptance of Polyester Film,” a sample sheet of **HERCULENE** Drafting Film, and samples of the Ruwe and Duralar Pencils.

Name & Title \_\_\_\_\_

Company & Address \_\_\_\_\_



# GRAPHIC SCIENCE

THIS ISSUE: 11,600 COPIES

1127 W  
**JANUARY 1961**

VOLUME 3 NUMBER 1

The Magazine of engineering drawing management, covering drafting, reproduction and microfilming, technical illustration, drawing standards and drawing filing in all industries.

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## DEPARTMENTS

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GRAPHIC SCIENCE is published monthly by Kinelow Publishing Company, Inc., Wilton Center, Wilton, Connecticut. (POrter 2-5564). Charles E. Rhine, president; Paul Yake, vice president; David Z. Orlow, secretary-treasurer. GRAPHIC SCIENCE is published (printed) at 116 Main St.,

Norwalk, Conn. Address changes, undeliverable copies, and orders for subscriptions should be sent to Editorial Offices, Wilton Center, Wilton, Connecticut. Postmaster: Form 3579 requested. Subscription rates: \$8.00 per year in the United States; \$9.00 per year to Canada; \$10.00 per

year to other countries. Single copies: \$1.00. ©Kinelow Publishing Company, Inc., 1960. Accepted as controlled circulation publication at Norwalk Conn. Member Business Publications Audit of Circulation, Inc.





# Letters

## Drafting Manuals Wanted

Sirs:

We are revising our Drawing Room procedures and wish to establish a uniform system of procedures based on a manual to cover all of our experiences.

This manual will serve the purpose of training new personnel, describing responsibilities and systemizing working, drawing and format based on good drafting procedures.

Would you have your readers assist us by suggesting manuals available and useful for this purpose, and a bibliography for investigation?

LEONARD GOODMAN

Technical Engineer  
Elco Corporation  
Philadelphia 24, Pa.

## Checking Time

Sirs:

We would appreciate any information or figures pertaining to an industrial standard or accepted rule of thumb figure on checking versus drafting time, i.e. if a draftsman takes X hours on a drawing, what should the checking time be?

While reading your magazine, which, I might add, is the first copy I have ever seen (May '60), I came across the fact that you send out "Subscription Questionnaires." I would appreciate one of the same.

GEORGE J. STRECK

Checking Dept.  
Radiation Incorporated  
Post Office Box 37  
Melbourne, Florida



## Good Time

Sirs:

In your September issue, page 19, Win Straube has written an article on "Revolution in the Drafting Room." The picture heading this article is greatly appreciated by our Tool Designers, since we have a girl working for us for some 17 years, and we dearly love to razz her about her ability, even though she is one of our better designers. All this, of course, is leading up to the question, is it possible to obtain an enlargement of this picture?

C. S. WESSENDORF

Chief Tool Engineer  
Clark Equipment Company  
Buchanan, Michigan

Sirs:

I have written to Mr. J. P. Pelamater, Director of Project Engineering Service, Librascope Div., General Precision, Inc., giving him the following time required for electronic and/or electromechanical drawings:

"A" size	2.5 hours
"B" size	5 hours
"C" size	10 hours
"D" size	20 hours

This time includes checking and releasing drawings. (Checking time is approximately 1/3 of the total time.) These drawings are drawn to the MIL specifications. I would appreciate hearing what other time charges are for these drawing sizes.

I. WILLIAM HOLLANDER

Chief Draftsman  
Hamilton Standard Division  
United Aircraft Corporation  
Windsor Locks, Connecticut

## Taping Hint

Sirs:

I have found that when making printed circuit masters I did not have any place to cut the tape or any good method of determining its length other than actually measuring from one pad to another.

To solve the problem I took a piece of plexiglas (clear) and placed my printed circuit tape and pads on it. When I want to join two pads together I place the plexiglas over the circuit with the tape running from one pad to another. After cutting the length of tape required I then lift the tape from the plexiglas and place it onto the circuit. By using this method I have been able to utilize al-

most every piece of tape.

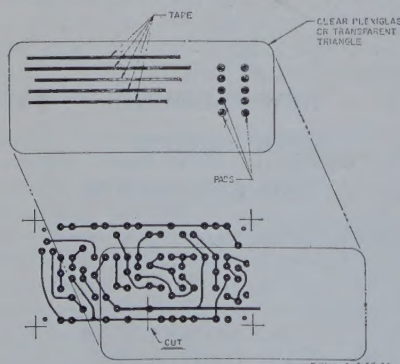
Following are some advantages of using this method:

1. Place to cut tape, thus avoiding cutting the drawing board cover.
2. Keep printed circuit materials within reach of draftsman at all times.
3. Eliminates using a scale when determining tape lengths.
4. If the job has to be set aside for any period of time, tape and pads can be left on the plexiglas until the job is resumed.
5. No need to pick up tape cuttings from board after job is completed as they are still on the plexiglas.

If plexiglas is not available an old triangle (transparent) will suffice. I hope that this method will be of some use to draftsmen who are involved in the design and layout of printed circuits.

ROBERT A. DOVE

Mechanical Draftsman  
Franklin Systems, Inc.  
2734 Hillsboro Road  
West Palm Beach, Florida



(Letters to the editor should be addressed to Wilton Center, Wilton, Connecticut. Names will be withheld upon request but all must be signed.)



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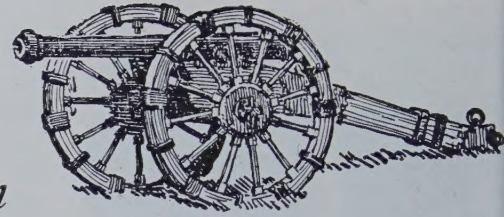


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# Military Engineering Documentation

by W. S. Hutchinson

## Defense Drawing Practice Industry Advisory Committee

**T**HE FIRST meeting of the reconstituted Committee was held in Washington, D. C., on October 31st with thirty-five military, industry, and university representatives attending. The knitting of minds of experts with wide diversification on problems confronting the Department of Defense will speed up the pace in finding practical solutions to drawing practice and related engineering documentation problems. It is important, therefore, that industry be kept abreast of Defense efforts in this vital area. The following report highlights the business transacted by the Committee.

Committee Chairman, Colonel Earl T. Wiley, Jr., USA, Chief, Standardization Division, Armed Forces Supply Support Center, opened the meeting by expressing his appreciation for the support that industry and universities were willing to give unselfishly to the Department of Defense in the program. Brigadier General I. L. Allen, USA, Deputy Director, AFSSC, next welcomed the members. He expressed his appreciation also for their assistance in devoting valuable time and skills to the solving of problems relating to drafting practices and engineering documentation.

"While the program for standardizing drafting practices is largely completed, except for keeping in step with technological advances," he said, "the next step is to systematize the management of drawings and engineering data. With the ever increasing mass of technical information coming into the various military activities, it is more necessary now than ever

before to establish integrated systems for storing, locating and distributing such information to those who need it."

Mr. John J. Dunn, Assistant for Policies and Programs, Standardization Division, AFSSC, stated that due to the increasing volume of engineering documents needed for the support of complex weapons, it becomes necessary to establish systems for handling this mass of information, and to determine the kinds and uses of documents which belong in each system. The systems must provide for distribution, filing, sorting, storage, revisions, issuing, reproduction, etc., of information as essential to fill the many needs of users. These include, maintenance, personnel training, equipment operation, engineering support, design evaluation, redesign, and identification.

Industry provides the equipment for basic support of national defense. In addition to this hardware, industry furnishes tremendous amounts of data for support purposes. It becomes necessary, Mr. Dunn indicated, to become more conscious of systems for managing not only the hardware, but also the supporting engineering data; it must be handled much faster than ever before. For this, computers and various other kinds of automatic machines are being used at present by both the services and by industry. Efforts must be to make the various systems compatible with one another to the maximum extent possible.

The work accomplished by military and industry personnel in developing MIL-D-70327 had the good effect of

focusing attention on all tasks related to the preparation of engineering documents. It is intended to call upon additional experts, Mr. Dunn said, to augment the present Committee as new areas are defined.

Colonel Wiley considered the main areas of engineering documentation to consist of drawing practices, design criteria, performance and test data, and engineering data (including microfilm) systems; he stressed that the engineering data systems area was of primary importance.

The Committee will assist, said Colonel Wiley, in the process of developing overall methods whereby engineering information can be distributed rapidly, both within the military and to contractors. This will help to eliminate the expensive practice of paying over and over again for the same solution, he added. At present, engineers do not have the necessary detailed information that exists in the various fields of engineering. They are forced, therefore, to spend time in research to find out what has been accomplished. A basic objective of the program will be to establish a central depository for engineering information that will be available to engineers upon request. By making stored information readily available for design evaluation, the costly practice of duplicating the same designs repeatedly can be minimized.

In response to questions by members of the Industry Advisory Committee, the following points were clarified:

1. The Department of Defense Instruction No. 5126.21 establishing the



Industry Advisory Committee states that the purpose is to provide advice in the development of a program to foster standardization and unification of engineering drawings and related practices in accordance with general provisions of Department of Defense Directives Nos. 4120.3 and 5154.14. Directive No. 4120.3 pertains to the Defense Standardization Program. Directive No. 5154.14 established the Armed Forces Supply Support Center, and defines its purpose and objectives. While the purpose and objectives are quite general, it is intended that the Industry Advisory Committee will concentrate efforts on engineering documentation.

2. Members act as individuals, and do not represent any industry, industrial association, or trade association; however, they will help the Defense Standardization Program if members tell the ideas developed by the Committee to their companies, associations, or societies.

3. AdHoc committee very likely will be established as new areas are studied, or when other experts are needed.

4. The military members of the Committee (as a group) will not meet or act separately under the sponsorship of the AFSSC on problems considered by the Committee.

5. It is expected to hold about three meetings a year. After the program is better defined, the meetings may be held less often.

6. The members of the Committee and Subcommittees that may be established are expected to make recommendations for consideration of the whole Committee.

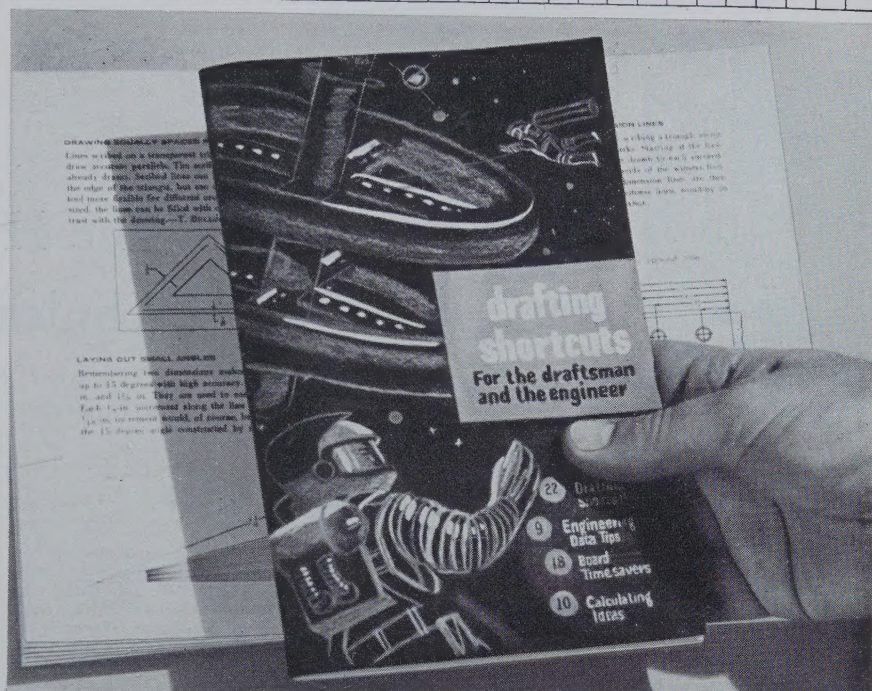
7. Assignments are made to the military departments for standardization projects. This Committee will not be expected to work on projects directly to the extent of producing documents.

8. The Charter (DOD Instruction) of this Committee is continuous until cancelled by authority.

9. Problems brought up in meetings are considered as being presented by the member, and not by the company or association to which he is attached.

A summary of the current status of projects within the scope of the standardization Plan for DOD Standard Drawing Practices, covering fiscal years 1960, 61 and 62, will appear in this column next month.

# DRAFTING TRENDS



## Helpful new booklet suggests drafting, engineering shortcuts

Just published—"DRAFTING SHORTCUTS" is a completely new booklet of helpful ideas and aids for engineers, draftsmen and students. It is well illustrated, clearly and logically written. It contains a wealth of time-saving tips to speed both routine and specialized tasks.

The ideas selected were submitted by professionals and judged by an impartial panel of widely recognized authorities on the various topics covered.

As an example, the section covering *Calculating Ideas* includes a simple means of locating stress points on cantilevered beams, also a simple method for retaining fundamental trigonometric relations.

In the section on *Drafting Shortcuts*, our editors have come up with topics like a simplified, fast and easy method for drawing gear teeth profiles and a rapid means of showing twisted wire elements.

The *Engineering Data* section covers new, easy-to-use shortcuts to formulas and engineering data.

There's a special section devoted to time-saving techniques on the drawing board, too. One of the suggestions on how to make life easier for the draftsman tells how to use a bent paper clip as a variable guide for making section lines.

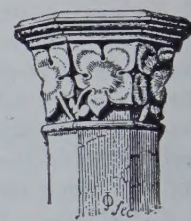


For your free copy of "Drafting Shortcuts" contact your POST dealer or write today to the Frederick Post Company, 3656 N. Avondale Avenue, Chicago 18, Illinois.



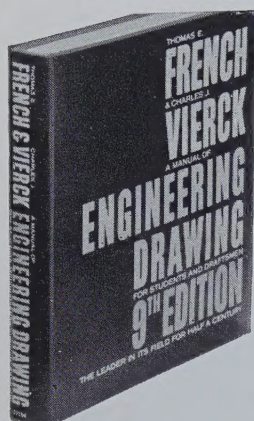
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### Ninth Edition of FRENCH'S A Manual of ENGINEERING DRAWING

By Thomas E. French  
formerly, The Ohio State University  
and Charles J. Vierck  
University of Florida with the assistance of  
Ralph S. Paffenbarger  
The Ohio State University  
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- ASA thread symbols
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## The History of Technical Drawing

by Franz Maria Feldhaus

This chapter comprises the remainder of Part II, of an authoritative and beautiful book, **THE HISTORY OF TECHNICAL DRAWING**, by Franz Maria Feldhaus published in 1959 by Franz Kuhlmann, K.G., of Wilhelmshaven, Germany, as **GESCHICHTE DES TECHNISCHEN ZEICHNENS**. We are indebted to the publisher for the translation, as well as for permission to re-publish this fascinating work. It will be continued in this department from month to month, until completed.—THE EDITORS.

**H**OW LARGE the chart rooms must have been in which about 600 plans were stored for the biggest irrigation work on earth, (36,000 miles long), built under the Chinese Emperor Kublai Khan! Engineers were held in high esteem in China. History tells that the engineer Yu was made Emperor because he was the first person to dike-in the dangerous Hoangho river, named the Sorrow of China.

The great Caliph Hārūn al Raschid equipped a technical school in Baghdad around 807 A.D. Little is known about the positions engineers occupied during the Crusades. Because Palestine was a country poor in timber, any equipment needed in those wars had to be carried along. Even during the first Crusade an arsenal with extensive workshops was set up in Venice. It was to play an important role in the history of this great port, from which came the large fleets that would rule the seas for hundreds of years thereafter. The prosperity, peace and safety of all Venetian provinces accessible from the sea depended upon this arsenal. Technicians and the

body of workmen belonging to it formed their own highly esteemed rank. Before starting their daily work, the *Arsenalotti* greeted the Holy Marcus, patron of the town, by a loud cheer. In the 16th Century the arsenal had a labor force of over 15,000. The workshops had the best available equipment. The archives of Venice consisting of more than 300 rooms, held more than 14,000,000 documents, many of which are technical drawings dating back to the 10th Century. A still larger number dating from the middle ages are kept in the archives of the Vatican in Rome.

From about 1160 A.D. we hear of a master engineer (*maitre enginier*).



The Engineering Mind—  
A Caricature from 1890



In 1196 A.D. an *encignerius* is reported from Milan. In 1238 the form *incignerius* is used in Brescia. A French *maistre engignierre* took part in the 1248 Crusade. The builder of equipment used in warfare was called the *antwerckmeister* at about 1300, his equipment, the *antwerck*. The war-engineer went where he was able to find employment: he had no conception of nationality.

The German engineer was held in high esteem everywhere in the 15th century, the Italian in the 16th and in the following century the Dutch engineer—the latter especially as a builder of mills. The French Engineer is mentioned in the 18th century.

Leonardo da Vinci, the most versatile engineer of all, was the first person to draw machines truthfully because he saw them with the eyes of an artist. Under the son of Pope Cesare Borgia he was given the title of Engineer-General. Dominico Fontana, who erected the obelisks in Rome, was made Major-Engineer by the Spanish Viceroy in 1592. The word, "engineer," was probably first used in Germany from August 8th 1651; the title "Head-Engineer" in 1697. The big universal lexicon by Zedler defines the following in 1744: "*Technica Engenia* are those who occupy themselves with all kinds of artistic objects; *Technica* means the teaching of art."

In 1432 the archives of Frankfurt a.M. mention a "molecular doctor" who had to maintain the cogwheels, the drive and the moving parts of the bridge mill in Frankfurt. A lively description of the life of "mill-doctors," who wandered through the land and called at the mills to repair and maintain them, was written by William Fairbairn, the English engineer who himself had started as one of them. Builders of machines were called "machinists" in the 18th century. The first woman to take the engineers examinations in 1917 in Goteborg, Sweden, was Vera Sandberg.

The word "technology," as a collective conception of technical knowledge, used to have a different meaning. In antiquity and for long after that, "technology" was the *tèchne* of the *logos*, not the *logos* of the *tèchne*. Only in 1777 was technology established as a science by Professor Johann Beckmann of Göttingen.

On the occasion of the centenary of  
(Continued on page 26)



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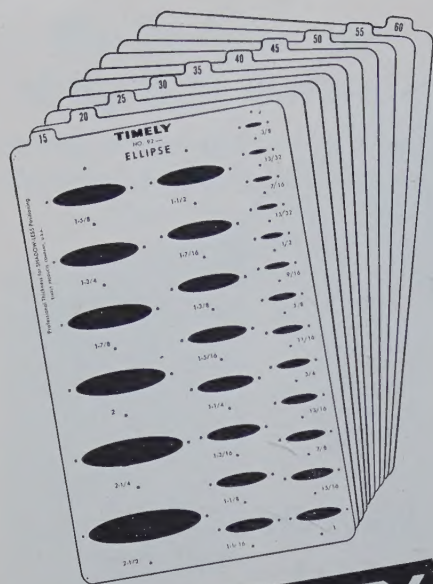
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## Notes & Comment

### Engineering Illustrators

IN RESPONSE to our query, and that of numerous readers of the article, "Engineering Illustration Today" by Roland C. Alexander in the November issue, we have received the following information from Mr. R. E. Hallagan, Director, Society of Engineering Illustrators, Inc.:

"To quote from the Constitution and By-Laws: 'The Society of Engineering Illustrators, Inc., is a non-profit organization established for the benefit of all Illustration personnel employed in this field. The object of the Society is to advance the profession of Engineering Illustration, its allied arts and sciences, by these principal means: (a) To conduct scheduled meetings whereby members may coordinate their efforts relative to the attainment of our objective. (b) To provide a higher degree of recognition for the Engineering Illustration profession. (c) To cultivate and promote interest of Engineering Illustrators and to broaden the scope of our profession. (d) To assist and encourage Engineering Illustrators by providing facilities for their participation in classes of instruction, lectures and other methods of improvement. (e) To aid in the promotion of research to further the growth, through practical use and application, of Engineering Illustration.'

"The Society's main offices are located in the Rackham Memorial Bldg., 11 Fransworth, Detroit, Michigan."

Our thanks to Mr. Hallagan and Mr. Alexander for their help in bringing articles about this field to the attention of GRAPHIC SCIENCE readers.

### Microfilm Association

THE 1961 Meeting and Convention of the National Microfilm Association will be held April 4-6, at the Hotel Sherman, Chicago, Ill. Theme of this, the NMA's 10th Annual program, is "Systems and Standards—A New Era in Microreproduction." Exhibits will contain cameras, processing machines, readers, enlargers, insert, and aperture cards, mechanical handling equipment, continuous paper reproduction printers, and new processing solutions.

Vernon D. Tate, Executive Secretary of NMA, P.O. Box 386, Annapolis, Md., has information regarding registration, exhibiting, and the like.

### Drafting — Reproduction Seminars

ASSOCIATE EDITOR Jay H. Bergen, Mr. William E. Hoffman, and Mr. Kenneth E. Swarmer are leaders in a series of three seminars being sponsored by the National Institute of Management, Inc., Suite 618, National City Bank Bldg., Cleveland 14, Ohio. Seminars are being held in Chicago January 23-24-25, and in New York January 30-31-February 1. In each series, the first will cover Managing the Drafting Function; the second, Simplifying Your Drafting Procedures; and the third, Making Reproduction Work for You.

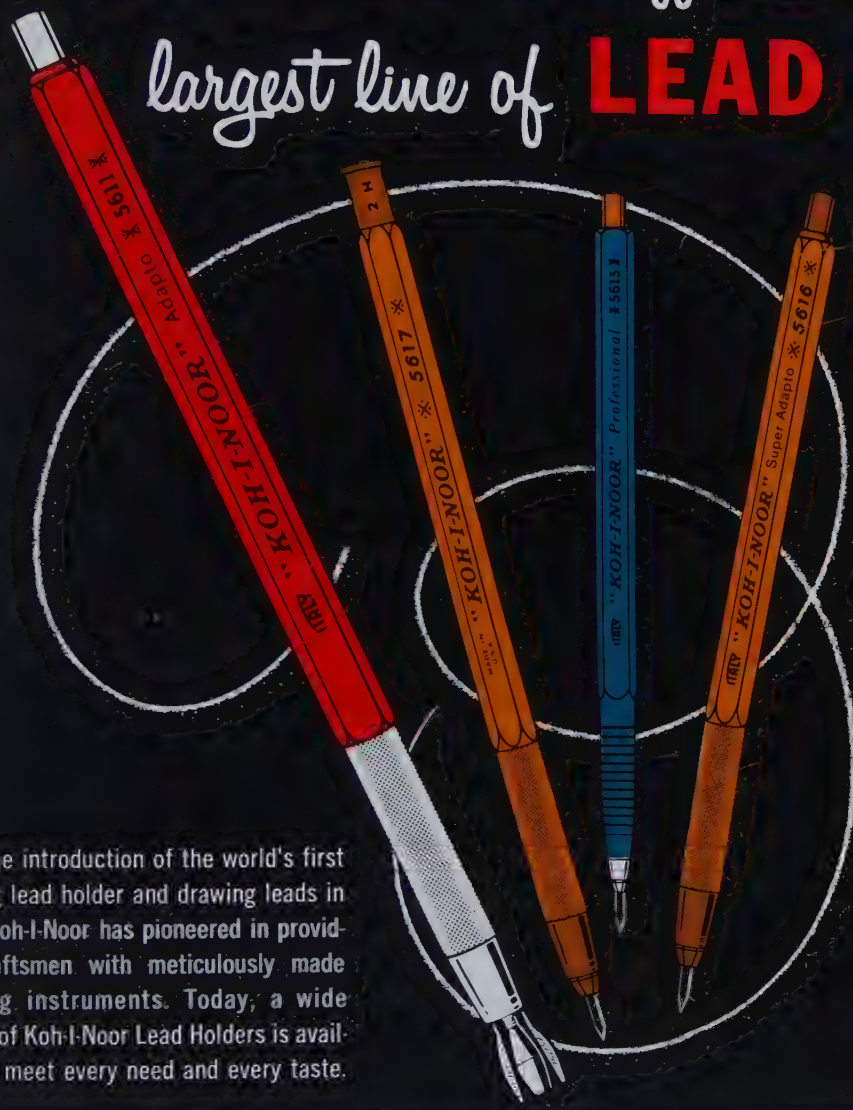
### Antiques

THANKS to the many individuals and companies who helped make the GRAPHIC SCIENCE exhibit at the recent VCC conference in Chicago a thorough success!



# KOH-I-NOOR offers the world's largest line of **LEAD HOLDERS**

From the introduction of the world's first drafting lead holder and drawing leads in 1955, Koh-I-Noor has pioneered in providing draftsmen with meticulously made drawing instruments. Today, a wide choice of Koh-I-Noor Lead Holders is available to meet every need and every taste.



**No. 5611**—All metal, balanced, lightweight, with knurled finger grip. Patented "Adapto-Clutch" holds complete range of lead diameters. Replaceable clutch is non-turn, non-slip. "Color-Coded" push button identifies lead degrees.

**No. 5617**—Non-slip, non-turn "Adapto-Clutch" takes all diameters in 17 degrees of lead. Push button control has built-in degree indicator. Perfectly balanced, with knurled finger grip.

**No. 5613**—New, lightweight, low priced, quality holder, perfectly balanced, with non-slip, non-turn replaceable clutch.

**No. 5616**—Same as No. 5617 above, but without built-in degree indicator.

## and **DRAWING LEADS...**

**\* No. 2200-M  
KOH-I-LAR  
PLASTIC LEADS**  
degrees (6H, 4H, 2H, HB, B, for use on DRAFTING FILM, Ejectomatic Dispenser.

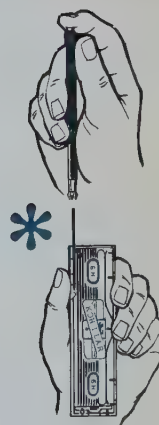
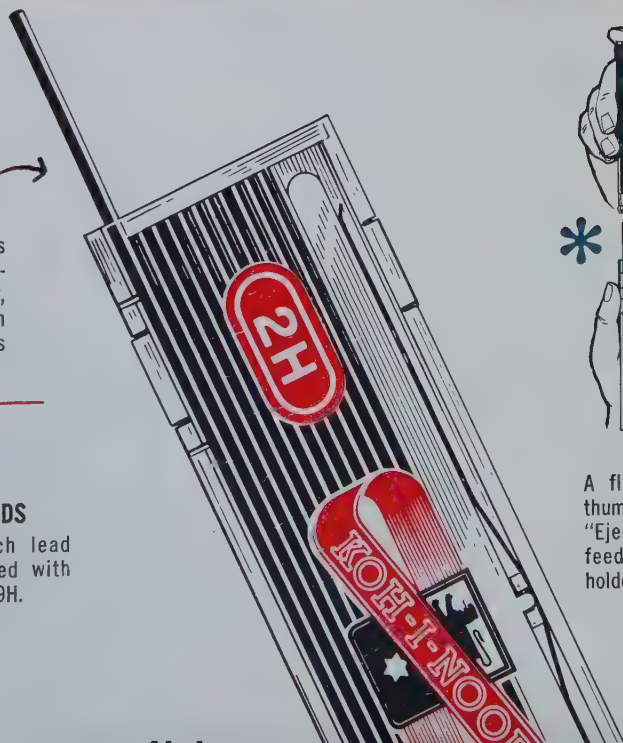
### **No. 2200-I NEW EJECTOMATIC LEAD DISPENSER**

A flip of the thumb feeds lead from this compact plastic dispenser to the holder, cleanly without need to touch lead. Available in 17 degrees of graphite and 9 colors.

**No. 2200-D  
DUETTE**  
Handy plastic slide-top box contains 2 sharpened and imprinted leads of a degree. Available in all 17 degrees.



**No. 2200  
GRAPHITE  
DRAWING LEADS**  
Six to a box, each lead pointed and stamped with degree. 6B through 9H.



A flip of the thumb... and "Ejectomatic" feeds lead to holder.

**KOH-I-NOOR**





# KOH-I-NOOR

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Koh-I-Noor offers draftsmen an important new dimension in a comprehensive line of instruments and accessories meticulously matched to provide new high levels of professional performance, efficiency and convenience.

### **NOW...TWO KOH-I-NOOR RAPIDOGRAPH TECHNICAL FOUNTAIN PENS**

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**MODEL NO. 3065:** A new model with 7 interchangeable drawing point sections, each "Color-Coded" to indicate a different line width. Best buy for the professional who requires frequent change of line widths. Each drawing point section complete with airtight refillable ink cartridge. Interchange is accomplished quickly, cleanly. Comes in handy desk top container.

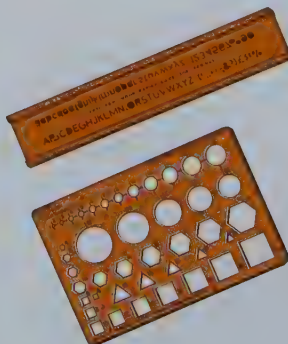
**MODEL NO. 3060:** The regular Koh-I-Noor Rapidograph Technical Fountain Pen with self-contained automatic filling system, and pocket clip, is a standard drafting room tool.

*Send for Descriptive Literature*



### **KOH-I-NOOR RAPIDOGUIDE and TEMPLATES**

**for use with corresponding Rapidograph Pens**



**Rapidoguides:** High quality lettering guides with elevating metal rails, developed to fit the seven different point sizes of Rapidograph Technical Fountain Pens. Each Koh-I-Noor Rapidoguide has upper and lower case letters, numerals, and characters, all on one guide.

**Templates:** Precision engineered for use with Rapidograph Fountain Pen, Koh-I-Noor Drawing Pencil, Leads and "Adapto-Clutch" Lead Holders.

# KOH-I-NOOR

Inc., Bloomsbury, N. Y.



# Photographic Drafting at Magnavox

*Assembly drawings of printed circuits and components can be developed economically if prerequisites are taken into account, and these steps are followed*

by Walter H. Friedrich

**D**RRAFTING REPRESENTS a source of considerable expenditure in both time and money for any electronic or engineering company. The expense stems not only from the actual man-hours on the boards, but also from the long period of apprenticeship necessary to produce an expert draftsman trained in company procedures. There is no question that the function performed in drafting is essential; the only questions are how to cut expenses and reduce the drafting time-lag.

## WHAT IS PHOTOGRAPHIC DRAFTING

**T**HE Magnavox Company has recently initiated a system of photographic drafting which not only reduces expense and time-span, but also results in a more desirable end product.

In its simplest terms, photographic drafting at Magnavox consists of the following: (1) Photographing the "top" of an assembled printed circuit board; (2) Reproducing this photograph, along with a print of the circuitry, on a mylar or velum master; (3) Adding manually any required ink lines or characters to the print of the circuitry.

This photographic process is roughly equivalent in expense to six hours of drafting time. Hence, there are two prerequisites for the use of photographic drafting: That the drafting, if done manually, would take more than six hours; and that an assembled printed circuit board be available.

Since virtually all units ready for

the assembly drawing stage have been "breadboarded," the availability of the printed board normally represents no problem.

Figure 1 shows a typical assembly drawing made by the photographic drafting technique. A number of advantages over conventional drafting are immediately evident.

- Ninety percent of the drawing is made photographically.
- The components and the circuitry are shown pictorially, making the assembly much easier to visualize.
- The holes that receive the components are clearly shown, and the components are represented schematically and marked with item numbers. (Where duplicate items are called for, it is necessary to add the reference symbols as shown.) Therefore, the assembly operator does not need a schematic drawing or model.
- The drawing can be enlarged if necessary and used by Industrial Engineering for production planning and processing.
- The drawing can be used by inspection personnel to pinpoint trouble areas or parts for replacement or repair.
- The drawing fulfills the Bureau of Naval Weapons' requirements that the components' position relative to the circuitry be shown.

## GENERAL PROCEDURE

**D**ETAILED PROCEDURES for each step of the photographic drafting process are given at the end of

this article. In general, the process can be divided into four phases consisting of 12 basic steps.

### Phase A . . . Top Drawing

- (1) Photograph the assembled printed circuit board.
- (2) Process the negative.
- (3) Make a contact glossy print from this negative.
- (4) Make an enlarged negative with 120-line screen from the glossy print using the 20x24 process camera.
- (5) Process the negative.

### Phase B . . . Bottom Drawing

- (6) Make a contact glossy print of the circuitry. Use negative "B" (paragraph 3-2-10, Magnavox Drafting Manual) which was made from the tape master.
- (7) In the 20x24 process camera make a negative from this glossy print. The negative should be the same relative size as the negative made in Step 4 of Phase A.
- (8) Process the negative.

### Phase C . . . Combining

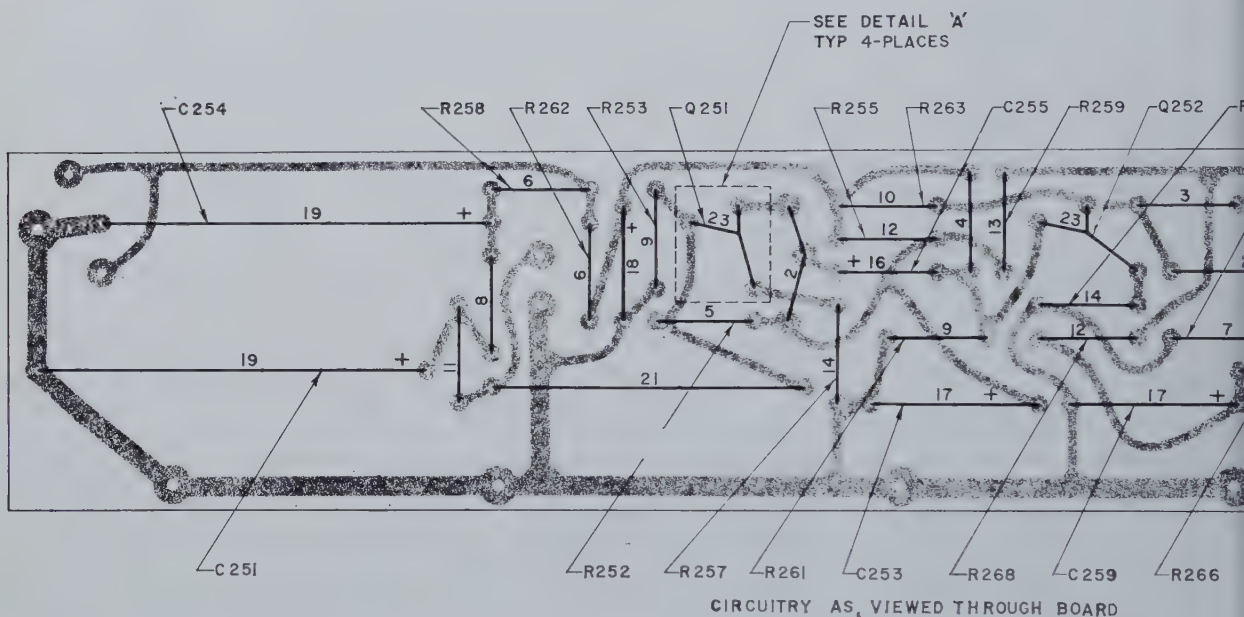
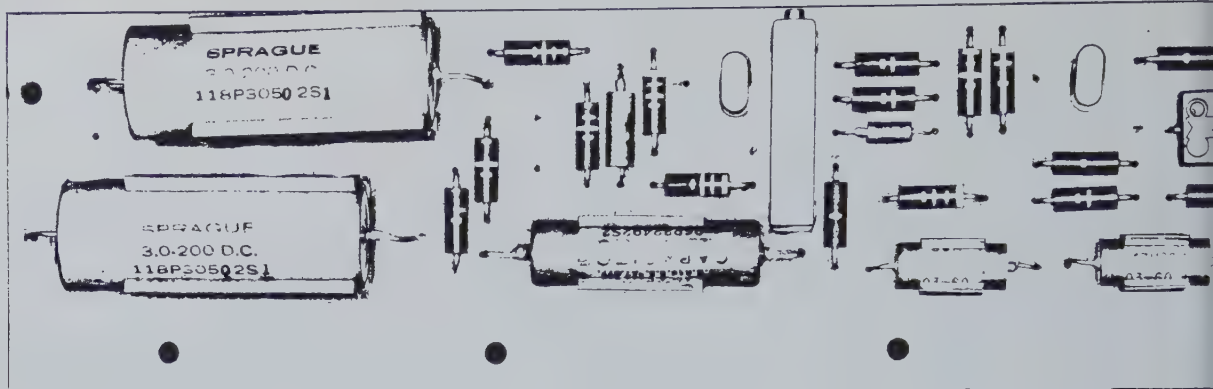
- (9) On the Magnavox standard format make a contact print of negative No. 5 of Phase A and negative No. 8 of Phase B.

### Phase D . . . Manual Operation

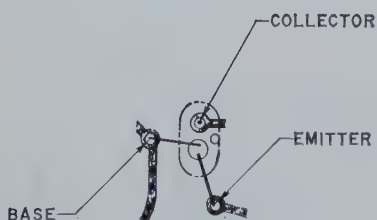
- (10) Add ink lines and characters representing the components.
- (11) Type the Bill of Material and add to the drawing.
- (12) Add the title and part number, completing the drawing.

Equipment used by The Magnavox Company for the Photographic Drafting process is below.

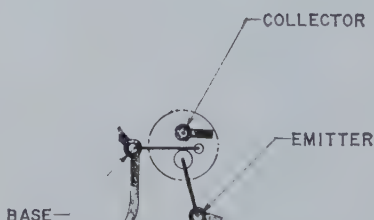




CIRCUITRY AS, VIEWED THROUGH BOARD



DETAIL 'A'  
CONNECTION FOR  
ITEM 23



DETAIL 'A'  
OPTIONAL CONNECTION  
FOR ITEM 23

UNLESS OTHERWISE SPECIFIED				SIGNATURE	
DIMENSIONS ARE IN INCHES DO NOT SCALE DWG.				DR.	<i>[Signature]</i>
TOLERANCES ON				CHK.	<i>[Signature]</i>
DEC.	FRACT.	ANG.	RMS FIN.	DSGN	<i>[Signature]</i>
MATERIAL:				ENGR.	<i>[Signature]</i>
FINISH:				PROJ.	<i>[Signature]</i>
				ENGR.	<i>[Signature]</i>
				APPD.	<i>[Signature]</i>

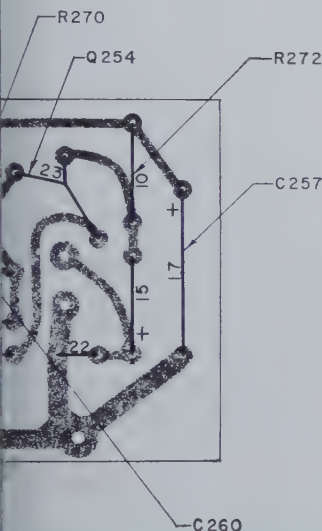
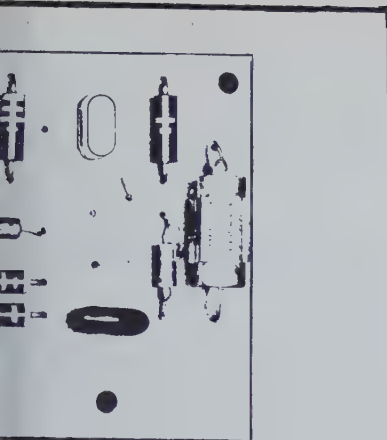
EST. GROSS WT.	DWG.	
#/1000 UNITS	ITEM NO.	Q. NO.

- 1-8x10 view camera with 13-inch lens.
- 1-Type "B" Hine light.
- 1-Camera tripod.
- AR-Eastman Royal Pan film ASA-160 (set meter at 320).

- 1-Norwood meter.
- 1-Process camera complete.
- AR-Kodalith process film.
- AR-Sensitized contact mylar film.
- AR-Incidental accessories, including half-tone screens.

Most companies which would employ the photographic drafting technique already have some or all of the above equipment (or its equivalent) in use in their photographic laboratories.





TIER, QUENCY MBLY	<b>THE MAGNAVOX COMPANY</b>	
	PORT WAYNE, INDIANA	
	DWG. NO.	-
DWG. SIZE	-	-
<b>D</b>	CODE NO. 37695	SHEET OF

#### DETAILED PROCEDURES

**PHASE A** (1) Place the assembled printed circuit board at right angles to the axis of the lens of the camera at a distance to produce the

largest possible image on the ground glass. Block out the underside of the board to prevent light from showing through translucent boards. Place the board on a black matte background to give better contrast between board and components.

(2) Check the camera with an accurate level.

(3) Center the image on the ground glass to reduce distortion. Check the image for bright reflections; if necessary, tilt the board slightly or touch up the bright spots with a non-reflective medium such as Krylon Dulling Spray #1310.

(4) Before making the photograph check the image in the ground glass; if a component is hidden, attempt to correct by moving the obscuring item to one side. (This may occur on boards 10 inches or longer where the photographic perspective due to the lens and camera limitations creates distortion.)

(5) Determine the correct exposure, using a meter, and calculate the necessary multiplying factor for the bellow extension. This formula is  $(13 + 7)^2$

$13^2 = \text{factor, when the total extension is 20 inches and focal length of the lens is 13 inches.}$

(6) Use Royal Pan film and develop to a gamma of 0.65–0.70.

(7) From this negative make a contact 8 x 10 glossy print. It should have normal contrast showing all the detail.

(8) From this glossy print make a negative twice actual size, or as large as the 20 x 24 camera will permit. This negative will be referred to as negative "X." To produce better rendition of the highlights and shadows, place a 120-line magenta half-tone contact screen next to the emulsion side of the film. Film and screen are held securely by the vacuum plate at the rear of the camera. Use photomechanical Kodak Ortho film and Kodak D-85 developer, or equal.

**Phase B** (9) Make a contact glossy print of the circuitry using the master negative "B" made from the tape master.

(10) From this print make an enlarged negative (the same size as negative "X") in the process camera. This negative will be referred to as negative "Y." Use photomechanical Kodak Ortho film and Kodak D-85 developer, or equal.

**Phase C** (11) Strip-in negatives "X" and "Y" and opaque, preparatory to reproducing on the standard mylar Magnavox format. Negative "Y" is stripped in  $\frac{3}{4}$  inch directly below and in line with negative "X." However, negative "Y" is reversed—its glossy side will be in contact with the emulsion side of the Cronaflex material when it is reproduced. Thus negative "Y" will reproduce a picture of the circuitry as seen looking through the assembled board.

(12) To reduce the printing density of the circuitry of negative "Y," insert a 70-percent Ben Day screen between it and the Cronaflex material when the contact reproducible is made. Develop to maximum density. The resultant Cronaflex reproducible should show sharp detail with light background in the assembly picture. The circuitry picture should be sharply defined, but not so dense that ink lines representing components and items will not print through.

**Phase D** (13) To complete the drawing, the draftsman adds lines and characters depicting the components. To represent the components, use 1/32-inch lines for boards full size to twice actual size. Extend lines from the circumference of one hole to the circumference of the other. Use a .100 Leroy stick with a #0 pen to make the characters. Do not use an eraser, since this removes some of the photographic image. The ink can be washed off readily with a damp cloth.

(14) Type the Bill of Material on pressure sensitive material and apply to the mylar reproducible.

(15) Reproduce by Diazo method. The best Diazo print quality (test sample exposure 10,003) was made at speed 5. However, the significance of this test was that the same print exposure tolerance is permissible for pencil tracings and for Photographic Drafting.

#### The Author

WALTER H. FRIEDRICH is Engineering Coordinator, Government and Industrial Products Division, The Magnavox Company, Fort Wayne, Indiana.

*The author is indebted to the Engineering, Photo-Chemical, and Drafting Departments at Magnavox for their invaluable suggestions and co-operation.*



# Road Maps

*General Drafting Company prepares maps for use by motorists. Their procedures combine photogrammetry with drafting, and preparation of "copy" for camera.*

by Paul B. Lee

THE PREPARATION of a road map really begins many months before a drafting pen ever touches paper, or plastic, rather, since that is the medium used in the drafting operations at the Convent Station, N. J., offices of General Drafting Co., Inc. The map requires initial planning: What scale will it be? On what size sheet of paper will it be printed? What types of information will it include? And what supplementary elements, such as city insets, index, mileage table, or recreational information, will it carry?

And then comes the long, and in many parts of the world, difficult job of assembling the most up-to-date and accurate base materials and related information. Road map makers cannot go out into the field to do their own surveying. Not only would it be economically impossible, but geodetic surveying and topographic mapping are properly a government function. To be sure, a good road map maker does a great deal of field work, checking on latest road conditions, on new alignments or other data not shown on his base maps. General Drafting Co., Inc. maintains a sizable fleet of cars and its employees drive many thousands of miles every year keeping its maps up to date.

Census data must be procured, along with information about mileages, route numbers, airports, federal and state recreational areas, historic sites, golf and yacht clubs and the

multitude of other features of interest to the motorist.

And still we are not ready for "drafting" in its usual conception. First a hand-drawn compilation must be prepared showing every bit of information that will appear on the final map. This operation, requiring many

weeks of work, is really a synthesis bringing together the various types of information on a single sheet of film to make certain that all essential details can be included without crowding the map to the point of impairing its legibility. Names are hand-lettered to approximately the type size in



A MAP is planned to the last detail, including layout and style as well as paper, printing and folding, before compilation or drafting are started. A comprehensive layout and complete specifications are prepared for each department.



which they will later be set. Roads and other information are roughly but accurately plotted. Special symbols are used to indicate populations of cities and towns, and point-to-point distances are calculated and added to the map.

But, as Kipling said, that's another story. When the compilation draft is at long last completed and has been checked line for line and name for name by a second map editor, then it is ready for the drafting room.

Final drafting starts by photographing the compilation draft on stable base film. This, incidentally, is normally at twice the scale of the printed map that will eventually result. The compilation negative is contacted to a sheet of opaque white vinyl chloride acetate (Loftrite) of .010" gauge on which a high-sensitive non-photographic blue line solution has been applied in a standard lithographic whirler. This material has a fine-grained matte surface on which excellent line drafting can be done with a special ink for plastic materials. Currently we are using Pelikan T ink manufactured in Germany.

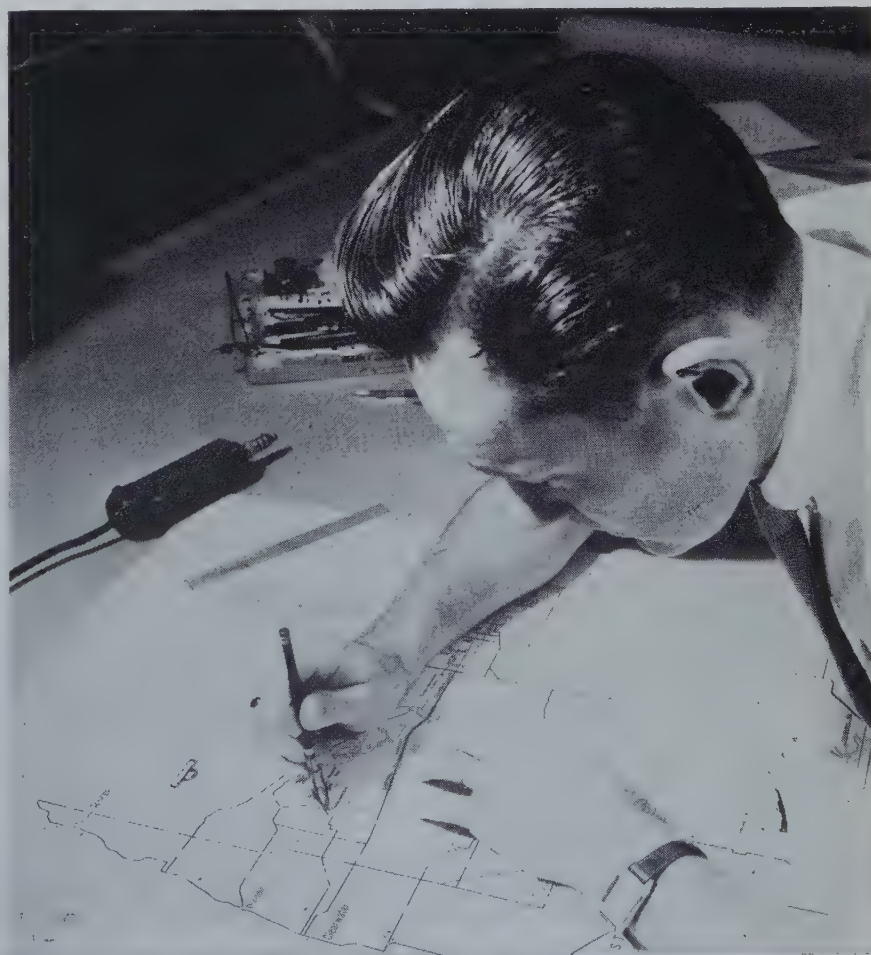
With the blue line image of the compilation draft before him, the final draftsman starts his work by drawing the city and town symbols over the entire map, some 3,000 of them on the average major production. Larger towns shown as areas with a dashed boundary outline are drawn freehand. Conventional circular symbols of various sizes are drawn with a bow pen. The lines, crosses or other elements within these circles are drawn freehand with a steel pen.

It should be mentioned at this point that General Drafting maps are drawn as a single master drawing in black and white, not as color-separation drawings or overlays. This ensures the best possible color register in printing. The color separations for 4-color printings are created by opaquing.

When the drafting of all town symbols is completed, the road lines are put in, using conventional road or contour swivel pens. In order to maintain accurate gauge, which is checked to .001" with a measuring microscope, the wider roads are drawn in double-line with a road or railroad pen. This method also ensures sharp clean edges for the lines. The space between the parallel lines is then filled by hand with a steel pen. Narrower roads may be drawn with a contour

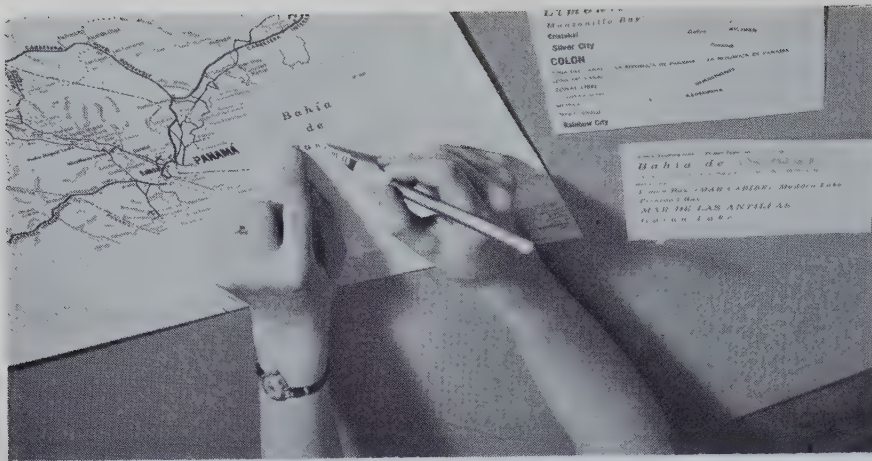


THE COMPILATION draft of a new road begins with photographing the selected base maps to the drawing scale. These negatives are then accurately mosaicked to fit a geographical projection and blue-lined by contacting to a sensitized sheet of white plastic. On this all information to appear on the final map is inked in black. When rephotographed the non-essential information in light blue disappears.



MOST roads are drawn as two parallel lines with this special double-line pen.





TYPE is placed on the map drawing by stick-up of adhesive-backed type (proofs).

pen or a regular ruling pen if they are straight lines as on many city maps.

Rivers, lakes, coastlines and most other line work except roads and boundaries are drawn freehand. Rivers, in particular, require great skill on the draftsman's part because they must be gradually and evenly tapered from the mouth to the headwaters of the stream. Boundaries are usually drawn by inking solid lines of the required gauge and then scratching out gaps to create dot-dash patterns of various types.

The final stage in the drafting is the application of the type for names of all kinds—cities and towns, rivers, mountains, altitudes, etc. — and the miscellaneous symbols for airports, campsites, mileage indicators, golf clubs and similar features. This is done by an operation usually referred to as "stick-up" or "floating."

The type is set by conventional methods—linotype, monotype or hand setting—and proved on a very accurate Vandercook press which imprints the image on both sides of a thin sheet of acetate in perfect register. This ensures maximum density of the inked image for good reproduction. After proving, the galleys of type are coated on the back with an opaque white pigment, then with a layer of pressure-sensitive wax and finally put down on sheets of glassine paper which keep the wax clean.

To apply the type to the drawing, the draftsman cuts closely around each name or symbol with a sharp frisket knife, lifts it off the glassine and burnishes it down on the plastic. Before burnishing down it can be shifted readily to precise position. Curved names are produced by cutting between the letters leaving only a

narrow attachment at the top or bottom of the line, so that the name can be bent into the appropriate curvature along a river, for example. The white backing on the proof automatically blocks out any line such as a road, river or boundary over which the name may fall.

When all drafting and stick-up are finished, the drawing goes back to the Compilation Department, where every detail is checked against the first draft and changes in data occurring since the work started are incorporated. After the drawing is finally checked and approved, it is ready for reproduction.

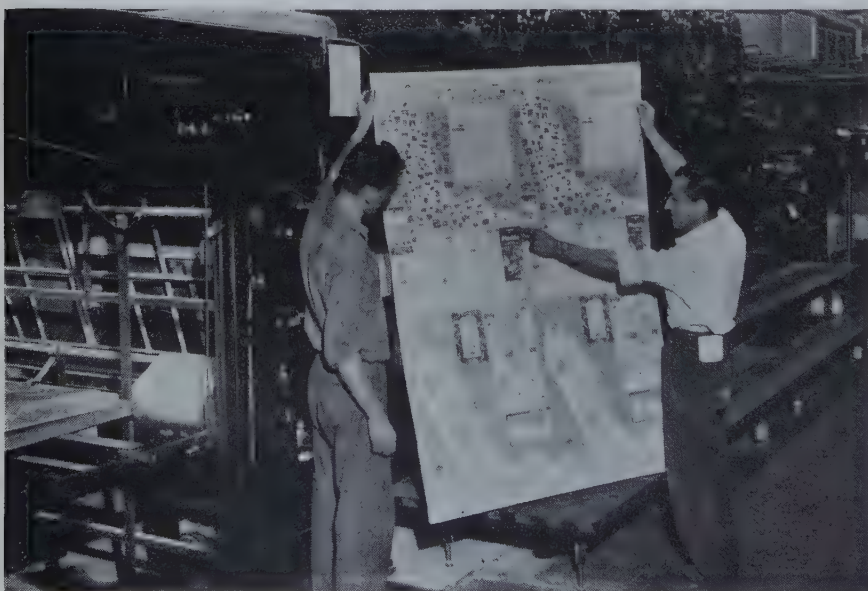
For this step, a negative reduced to reproduction scale is made on Cronar stable-base film. The lithographer, upon receipt of this negative, contacts it to glass, and all operations thereafter are on this medium in order to ensure the best possible register of colors in printing.

To reduce the description of the color-separation to its barest essentials, the lithographer makes three identical glass negatives. On each of these he paints out with opaque everything except the details that are to print in one of the three basic colors—dark blue, red and light blue. The fourth color, yellow, is prepared at a later stage by drawing up on the positive. Since our maps are printed by deep-etch offset lithography, the three basic negatives are contacted to positives, from which plates are made for hand proving. Again the map compilers are called upon to check the accuracy of the lithographer's work before the final printing plates are made for the production run.

And so ends a year's work, which is the average time required to produce the road map that motorists get free at their neighborhood gasoline station. They cost the distributor only a few pennies each simply because of the millions of copies that are printed annually from each drawing.

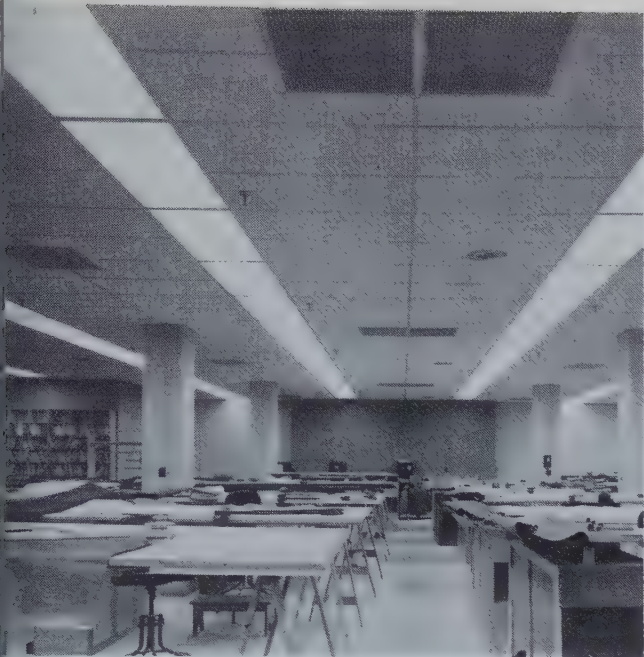
### The Author

PAUL B. LEE, assistant to the president of General Drafting Co., Inc., Convent Station, New Jersey, is currently in charge of all map work outside North America. In addition, he headed the firm's editorial-research department for some ten years. He is also a member of General Drafting's Board of Directors.



GIANT four-color presses turn out 4,000 to 5,000 sheets an hour. Each sheet contains four or more maps, which are then cut apart, trimmed and machine folded.





DRAFTING ROOM installation of Fiberglas light panels at Lockheed Aircraft Corporation's Marietta, Georgia plant has cut glare of new lights. Architect: Aeck & Associates.

## Glare Reduction

*Polarizing panels, plus increased light, Help reduce fatigue in drafting rooms*

THE AMOUNT of light available to the draftsman working on the board has a substantial effect on both the speed and quality of his performance, as two articles in the September 1960 issue of GRAPHIC SCIENCE pointed out, and the facts are by now, very well documented. Another, and unusual example of this was recently brought to our attention.

In the Marietta, Georgia plant of Lockheed Aircraft, lighting was increased from 65- to 150-foot candles last year when the drafting and design departments were working overtime toward the completion of production drawings for the Lockheed, 550-mph Jet Star utility transport.

Polarizing light panels were installed beneath the new 40-watt fluorescent lamps. According to company engineers, the new fixtures "helped reduce fatigue" and the panels made possible a noticeable reduction in both direct and reflected glare.

### DRAFTING ROOM LEADS WAY

ACCORDING to Mr. J. S. Johnston, Jr., plant electrical engineer, "We were so pleased with the new panels that we installed them in other areas in the plant, including our field service and training departments, and in a cafeteria. The panels give us flexibility of operation, enabling us to place draftsmen—in times of peak load—in areas of the plant other than drafting rooms with full assurance that lighting conditions will be satisfactory for the close work involved."

Architect for the Lockheed-Marietta building was Aeck & Associates; electrical engineer was Walter H. West & Assoc., and the fixtures manufacturer was Day-Brite Lighting, Inc.

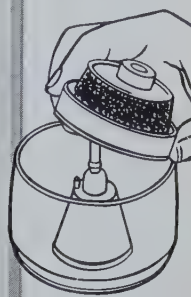
# Get the POINT

*you will with a*

**BOSTON** LEAD POINTER

The new Boston Lead Pointer is designed with the designer in mind. You make your own desired point by simply adjusting the length of the lead using the lines on the top for measuring the length of lead. The Boston Lead Pointer can be used as a portable or in a fixed position . . . leads won't break.

*Taper lengthens with length of lead.*



*Disposable refills come packaged three to a box.*

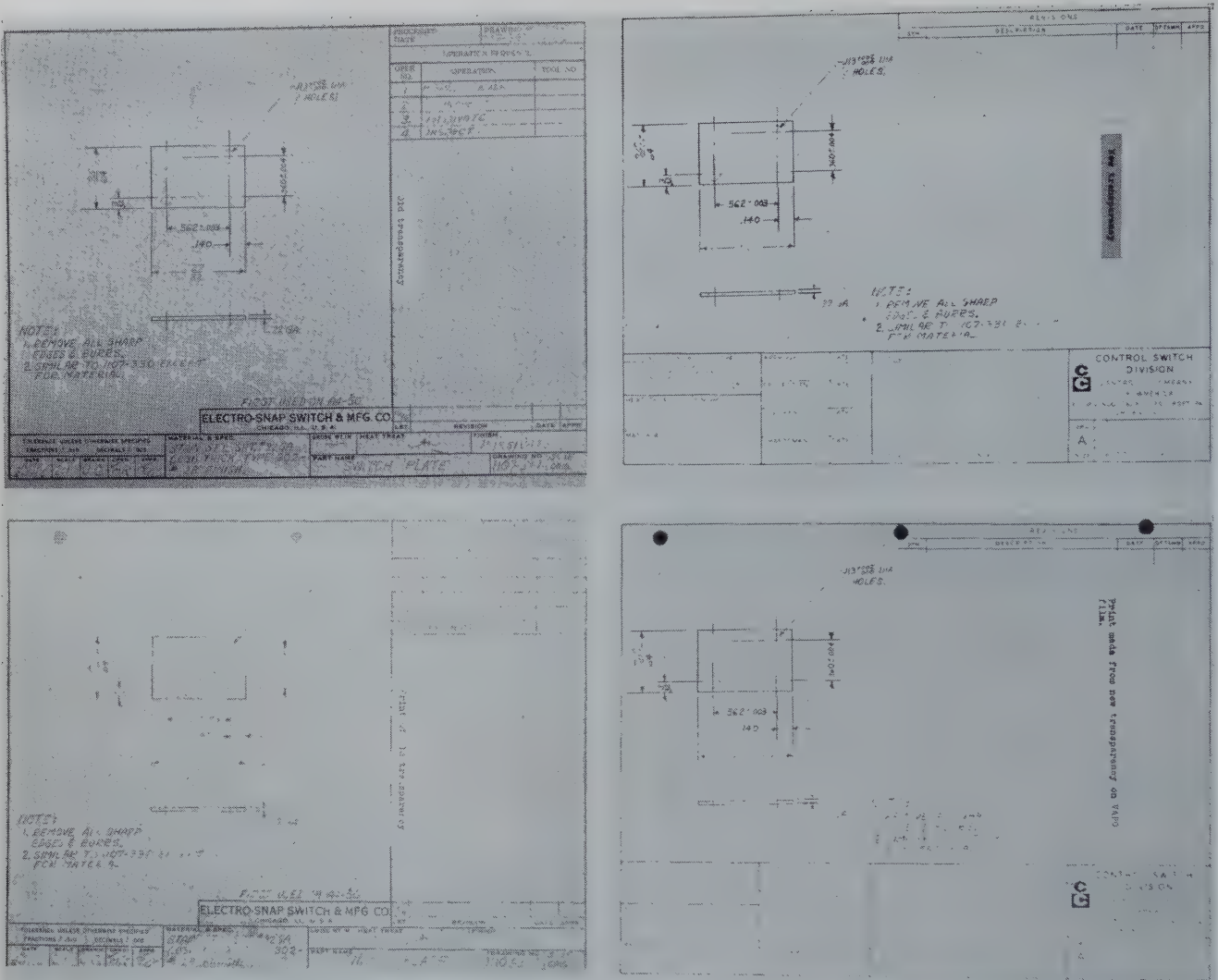


**CLEAN & QUICK  
REFILL CUPS**  
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the old. Drop in the  
new. No dirt . . .  
No mess.

*the NEW*  
**BOSTON** LEAD  
POINTER

C. HOWARD HUNT PEN COMPANY  
CAMDEN 1, NEW JERSEY





**RESTORATION:** On the left (top) an old tracing, and the print (below), resulting from its direct use. On right, (above), the Vapo Filmtex master produced via the yellow Chromtex intermediate, from the same tracing. Improved quality of print made from new master is shown clearly in bottom photograph.

# Intermediate Procedures

*A series of shortcuts to increase print reproduction, developed by Controls Company of America and two major suppliers of drafting-reproduction materials, satisfy the day-to-day demands for both quality and quantity*

by Clem Czapinski



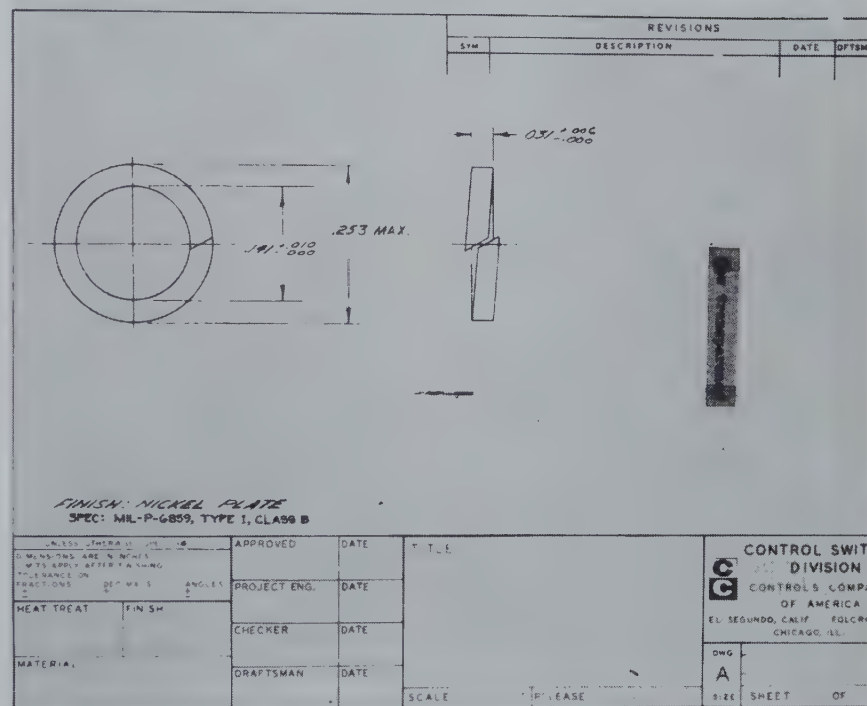
"We need 100 high-quality prints from this tracing, incorporating these changes, and we need them fast!" is a common request being made of drafting-reproduction departments in every industry, every day, throughout the United States. But the problems involved in filling such requests are many: to the chief engineer or head draftsman held to a tight department operation budget, they invariably include (1) How to satisfy daily print requests, (2) Obtain better quality of reproduction, (3) Avoid the waste in manhours lost in redrawing old tracings, and (4) Still turn out the required number of drawings on new projects.

The solutions do not necessarily happen overnight, as the following examples described by Clem Czapinski, advertising manager of Control Switch Division of Controls Company of America, 1420 Delmar Drive, Folcroft, Pa., show. Here they required the combined efforts of three engineers, the Frederick Post Company, 33656 Avondale Ave., Chicago 18, Ill., and The Eugene Dietzgen Co., Chicago 14, Ill., and more than three months time to develop and refine.

The basic materials finally arrived at, Czapinski reports, are Post's 200Y yellow Chromtex and Post's 208F Vapo Filmtex along with Dietzgen's sensitized Mylar film. Responsible for the procedures were Pete Belopavlovich, assistant chief engineer, Paul Keith, chief draftsman, and William Brettman, draftsman, of Control Switch Division, Chicago, Illinois. The Division manufactures switches, toggle switches, indicator lights, switchlites and special assemblies for military aircraft and missiles.

OUR PROBLEMS were the same as those of any engineering department, states Pete Belopavlovich. "We had to transfer vendor's (or another plant's) sepia print onto our own tracing sheet and supply a master drawing or rejuvenate old, worn out tracings, or combine a photograph with a master tracing—but still cut down on our drafting man hours.

"We started by working on the use of Post's 200Y yellow Chromtex as an intermediate (reproduction). By processing the Chromtex with an original tracing and then making



**TRANSFER AND CONSOLIDATION:** Above, a paste-up of the yellow line intermediates of the vendor's tracing and the Control Switch Division's tracing blank. The paste-up is reproduced, (below) on one master film transparency which is then used to produce high quality prints. Yellow intermediates, above, are Chromtex; film master, below, is Vapo Filmtex.

prints we found the print-quality greatly improved. But, this was not to be the final answer."

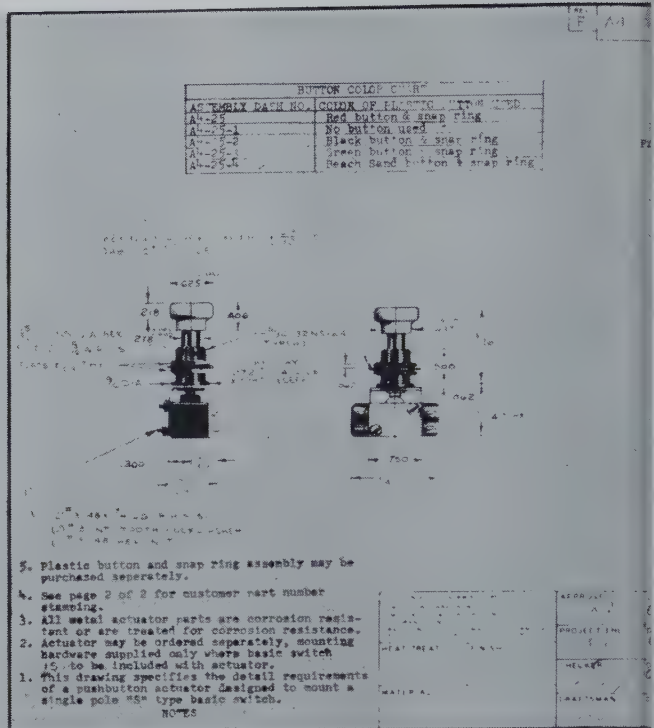
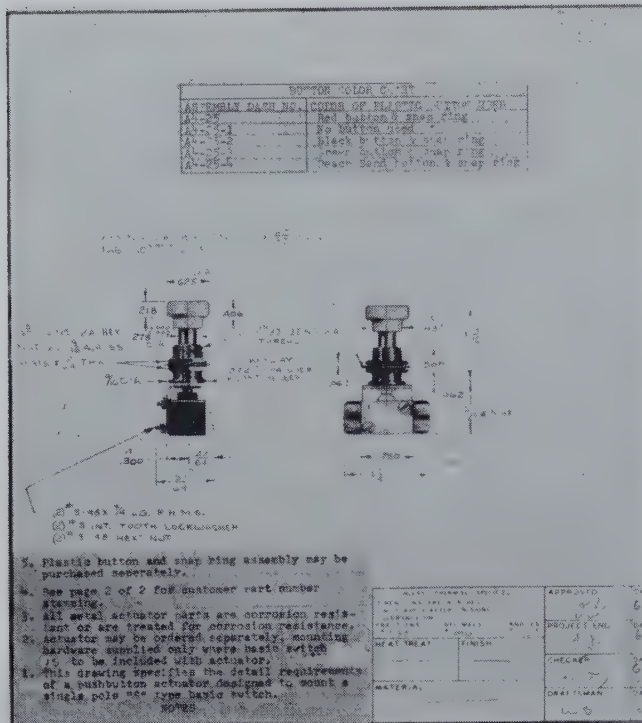
#### TRANSFER PROBLEM SOLVED

CARRYING this intermediate process further, Paul Keith, chief draftsman, began experimenting with Post's (208F) Vapo Filmtex. By transferring the yellow intermediate

(Chromtex) to the Vapo Filmtex, and then pulling prints from this Vapo Filmtex master, we received far superior copies. The reason for this is that the yellow intermediate has a higher opacity factor and thus transfers only the principal lines of the drawing, doing away with any background smudges.

Because our division was relatively





**PHOTO-TRACING COMPOSITE:** A comparison of prints made directly from the master composite tracing (Mylar positive and adhesive-back Mylar), left, and from the processed Vapo Filmtex master, right, again shows improved quality of print resulting from use of "intermediate." It is suitable for customer use. Direct print, left, is suitable for in-factory use only.

new we wanted to transfer many drawings from other plants to our own master Control Switch Division tracing sheets. The procedure we perfected is as follows: We transfer both a blank tracing sheet and the original tracing to individual yellow intermediates. Then we attach the yellow intermediate of the drawing to the yellow intermediate of the tracing blank with scotch tape and reproduce them on one Vapo Filmtex master. The result is a composite master tracing. This process reduced by two-thirds the drafting time ordinarily required to provide such a composite.

#### RESTORATION

**C**OSTLY DRAFTING man hours are spent when an often used and discolored tracings must be redrawn, Mr. Keith states.

"By transposing the old tracing to the yellow intermediate, then transposing this to the Vapo Filmtex we not only obtain superior prints, but also a master drawing on which corrections and/or revisions can be made easily. The old tracing can be filed. Depending on how complex the drawing may have been, we save anywhere from \$40 to \$70 in drafting costs and approximately 6-8 hours in

actual drafting man hours," Keith concluded.

Bill Brettman, draftsman, maintained productivity figures of the department during the development of the new process through a four month period this year. The results of his study show that production increased approximately 100% in the four months, mainly because new drawings of similar parts did not have to be made, and revisions could be done directly on the master Vapotex film.

His figures show that the average output of drawings-per-man/8 hour-day, at the start of the period, was approximately 2.7 but by the end it had increased to 5.4 drawings per man/8 hour day. The industry standard is approximately 2.9.

#### PHOTO-TRACING COMPOSITE

**T**HROUGH FURTHER DEVELOPMENT we have also been able to provide our sales department with prints of composite photo-tracings for customer proposals, Keith reports. In this case we make use of two Dietzgen products, Mylar Vandyke positive film (F230-2) and a sensitized adhesive-back Mylar film, (GF247CE-2).

"First, a photograph is taken of the product in proper scale. The nega-

tive is transferred photographically onto the Vandyke Mylar film producing a clear tone positive image. This film is then processed through the whiteprinter with a sheet of gummed-back mylar sheet. The gummed-back material with the image is separated from the Mylar, trimmed out to the approximate outline of the product and then applied to the back of the master tracing.

"Because prints developed from this master composite tracing show up as a shadowed or dark area they prove satisfactory for factory use only. For customer use, the Mylar composite is transferred to the yellow Chromtex which filters out all the discoloration and dark background. Then we duplicate on Vapo Filmtex to obtain a master file composite. This improves the quality of our customer prints, as well as cuts processing costs 100% Keith added.

Thus by application of a material that was used principally as an intermediate to obtain better prints (or as an overlay in sales promotion material), the Control Switch Division with the assistance of Post and Dietzgen, has been able to solve the problem of cutting costs, increasing productivity, improving quality of prints and filling blueprint requests on time.



# New Products



## Automatic Lead Pencil

No sharpening or lead pointing is required when draftsmen use the new Mark V "fine line" lead holder. Developed by Alvin & Co., Inc., 611 Palisado Ave., Windsor, Conn., the hexagonal unit has a fully-automatic, push-button lead feed (pre-loaded through top). According to the manufacturer, it is especially well suited for use with lettering guides or templates. Each lead holder comes supplied with six extra refill leads, available in nine degrees of lead hardness. Both standard (Mark V) and pocket models (Mark VP) are offered; both are moderately priced.



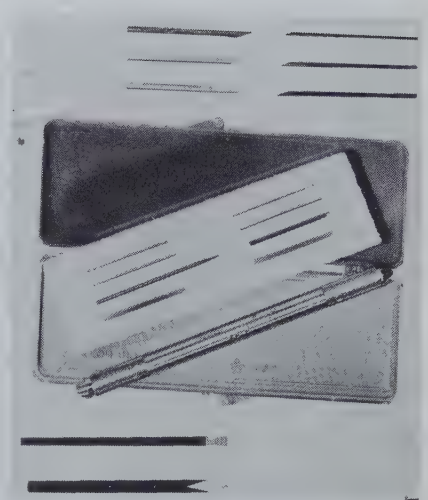
## Tube-Type Files

An Inter Lock File system, for efficient handling and storage of drawings, is being marketed by Pack Mfg. Co., Logan Utah. Individual units, of perforboard, have metal ends, require no frames or shelves, and permit color-coded indexing. Each tube can hold up to 30 drawings.

## Continuous Tone Diazo

Two products, both of which are designed to reproduce the quality of continuous tone photograph film positives via diazo, have been announced by the Ozalid Division of General Aniline & Film Corp., Johnson City, N. Y. The first, Hi-Gloss Black Dryphoto (108DZ), will reproduce a film positive as a black, glossy photographic print on white, plastic-coated stock. The material was originally designed for fast reproduction of aerial photographs, and in aerial mapping. Smooth and grainless, it can reportedly resolve more than 100 lines per mm. The company indicates that even the finest details in microimages can be reproduced with sharp clarity. It can be used with "screened" positives. The print is reported to stand up very well in handling and wear under field use. The Dryphoto can be used with automatic dodging equipment to produce glossies directly from the dodged, continuous tone positive. Applications would include the duplication of Polaroid transparencies, and written material prepared on a high-quality tracing film or cloth, as well. For in-plant use, the firm indicates that positive prints of negatives can be obtained by using their reversal foil. Brochure on Dryphoto is available.

The second product announced by Ozalid is a Continuous Tone Film (111CTF) designed specifically to compete with photographic films in the copying of continuous tone negatives and positive originals. Chief application for the product is expected to be the duplication of Polaroid transparencies for projection. In addition, the film is expected to find uses in the audio-visual field: the material has the ability to duplicate the full colors of a color transparency in black and white, with good orthochromatic rendition of the color value of the original.



## Needle Cutters

Tool kit consisting of a double-ended holder and six different sized needles has been developed by Griffin Mfg. Co., Inc., 1656 Ridge Road, East Webster, N. Y. The tools are said to be useful for ruling on negatives, for scratch board work, for plate making, and for litho engraving.

## Crow-Quill Pen

A crow-quill pen whose point is held in a two-way threaded nib which can be reversed to protect both the user and the pen point is a new addition to a DiCarlo line of pen points. Available from Craft & Hobby Co., Inc., 156 Forsythe St., S.W., Atlanta, Ga., the pen points are offered in fine and superfine sizes. A catalog, listing the crow-quill pen and others in the line is available.

## Liquid Developer

A Kodalith liquid developer has been announced by Eastman Kodak Co., Rochester 4, N. Y., permitting in-darkroom mixing of developer solutions quickly, and eliminating both the time required to measure and mix powder developers, and the possibility of contamination. Containers, holding concentrates of both solutions "A" and "B," are said to make darkroom solution preparation quick and clean. One two-gallon package will make 8 gallons of fully-mixed developer.

(For additional information regarding the new products described here, contact the manufacturer directly. Complete addresses are included.)



## New Products



### Photo-Composing Machine

A desk-top unit capable of producing finished type proofs in multiple lines on either 35 mm. film or paper has been announced by VariTyper Corp., 720 Frelinghuysen Ave., Newark 12, N. J. The Model 840 "Headliner" is operated by means of simple character-dialing; exposure developing, washing and fixing are automatically performed in 90 seconds. Fonts are available from 18- to 72 points.

### Polyester Diazo Films; Diazo Paper for Interfiling

Black and sepia polyester-base diazo films have been announced as suitable intermediates for the revision of drawings without changing the original. Films, Helios 517 (black) and Helios 517 were developed by Keuffel & Esser Co., Third and Adam Sts., Hoboken, N. J. In procedure, the films are printed in reverse, picking up the original copy; large deletions are made with a chemical eradicator, smaller ones with an abrasive eraser. For additions, the intermediate is turned over, so that copy is right-reading through the .003" base. Herculene film drawing surface permits use of pencil or ink. The black line film image has good actinic opacity, and excellent visual contrast for drawing purposes; sepia is superior for reproduction because of the higher actinic opacity: 8½ by 11-inch workshop

samples of each are available from the company.

The new diazo paper announced by K&E is described as interfileable with brownprints. The Sepia (499) meets recently released Department of Defense specifications which allow certain diazo-coated papers as interfileable intermediates in government contract work. (Previously, diazo intermediates were excluded because the coatings tended to "fade out" brownprints when they were in juxtaposition. Organizations involved who possessed only diazo copy facilities had to send out their drawings for brownprint intermediates.) Correction of the fade-out problem permits in-plant production of the intermediates, according to MIL-P-9853. Working size samples of the paper [Interfileable Sepia Paper (499)] are available.

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## The Book Shelf

**BASIC GRAPHICAL KINEMATICS**, by Harold B. Kepler, McGraw-Hill Book Company, Inc., New York, 1960 (\$6.00).

**K**INEMATICS is just one phase of the complex procedure of machine design. But once the essential kinematics, the motions necessary to accomplish the objective of a machine, has been determined, the remaining steps in design can proceed. If you are occasionally stuck and need a little help over a hurdle because you're rusty and out of practice or for some other reason, you might find your answer in Kepler's new, profusely illustrated textbook, **BASIC GRAPHICAL KINEMATICS**. The book stresses the graphical approach. Where possible Kepler presents derivations and explanations graphically; a reader can understand the material without knowing calculus.

All the traditional topics of kinematics are dealt with: displacements, velocities, accelerations, cams, gears, chains, and belts. Separate chapters present the drafting techniques needed to solve kinematics problems graphically, with vectors and vector equations, and with motion curves.

The equivalent linkage concept is discussed to simplify the analysis of many mechanisms that would otherwise involve the troublesome Coriolis's law, and similarly to obtain the acceleration of certain links. But Coriolis is not entirely neglected. Kepler offers a simplified explanation and proof that should help solve other problems that can't be worked out by the equivalent linkage method. The chapter on kinematic drawing and displacements is a special feature of the book. It familiarizes the reader with the manipulation of skeleton drawings and with specified constructions and techniques that are used in later chapters. It presents the drafting techniques and constructions involved in: (1) converting a working drawing of a kinematic skeleton drawing, and (2) the subsequent analysis of this skeleton drawing.

There is a wide selection of problems at the ends of the chapters, completely dimensioned and easy to lay out, in case you're interested in this kind of entertainment rather than in television westerns.

I.W.



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## Graphic Perspective

(Continued from page 9)

the Technical High School in Charlottenburg—it had grown out of the Building Academy which was founded in 1799—the title “Doctor-Engineer” was bestowed for the first time in Germany. Machine-drawing as a subject was already included in the curriculum in 1799.

Many technicians and inventors who became famous were laymen. Many a carpenter became a manufacturer of machines. Assistants graduated to engineers. Werner von Siemens, for instance, the reformer of electro-technique and founder of the power-current industry, was an officer. His brother, Sir William, became without previously having been trained for it, a leading cable, heating and steel engineer. A memorial window was put up for him in Westminster Abbey in London. His brother Friedrich, reformer of the glass industry, a remarkable heating and illumination technician, and inventor of the crematorium-oven, used to be a ship's boy and sailor.

*To Be Continued*

## New Products

### Replacement Lamps

The development of a new line of “Long-Life” mercury vapor quartz replacement lamps with universal terminals for whiteprint and blueprint machines has been announced by Copymation, Inc., 5650 North Western Ave., Chicago 45, Ill. Lamps, described as being “low-cost” replacements, are built to meet machine manufacturers’ specs, and fit units with the same wattage and voltage requirements.

### Print Cutter

A print cutter, developed by Superior Blue Print Co., 1922 4th Ave., Seattle 1, Washington, for its own use, is now being placed on the market. Unit, designed to supply straight cuts and eliminate torn prints, has been found to also speed up the operation. In addition to other features, it is said to be effective in working with the more expensive types of prints: vellum, tracing cloth and Mylar. It has a 46” capacity, and operates either by foot or air-power.

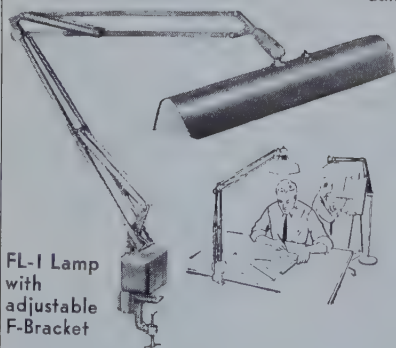


### Vertical Camera

A camera specifically designed for use with the Ektalith and Gevaert copy processes—as well as for usual commercial and graphic arts needs—has been announced by Lacey-Lucas Products, Inc., 31 Central Ave., Newark 2, N. J. The “Vertical 14” may be adapted to use as a dark room or galley camera. Among its features are an 18” by 24” useable area. Enlargement/reduction capacity is 250 percent; Wollensak lens.

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## New Literature

Tabulating Card Files and Supplies, brochure (No. LBV814), describing storage for tabulating cards and magnetic tapes, is available from Remington Rand Div., Sperry Rand Corp., 15 Park Ave., South, New York 10, N.Y. In addition to the customary vertical tabulating card file, the brochure illustrates and describes the test in mechanized filing equipment, as well as fire-proof insulated units. Several types of magnetic tape storage are also presented.

Film Reader Specification Sheet Form No. DL-4), describing Recordak Film Reader, Model MPC-1, may be requested from Graphic Microfilm Corp., 115 Liberty St., New York, N.Y. This microfilm reader, a companion unit for Recordak Micro-File machines, allows viewing of either 35mm or 35mm film. Recordak is the registered trademark of Recordak Corp., (Subs. of Eastman Kodak Co.) 15 Madison Ave., New York 17, N.Y.

Ball Point Pens Booklet (No. TF-BBP-1097.5[M]), describing colored ball point pens that can be used with thermo-Fax copying machines, is available by writing to Minnesota Mining and Manufacturing Co., St. Paul 6, Minn. More than 150 ball point and liquid graphite pens, made by over 50 manufacturers, are listed and rated according to their ability to give clear, sharp reproductions when used with the copying machine.

Microfilm Enlargement and Processing, a brochure describing the Rollacopy Process, may be requested from Andrews Paper & Chemical Co., Inc., P.O. Box 528, 676 Northern Blvd., Great Neck, N.Y. Rollacopy is a new photographic enlargement process perfected by Ets. Bauchet & Co. of France and introduced in the U.S. by Andrews Paper and Chemical Co. Rollacopy enlargement paper can be used in any overhead microfilm reader or photographic enlarger.

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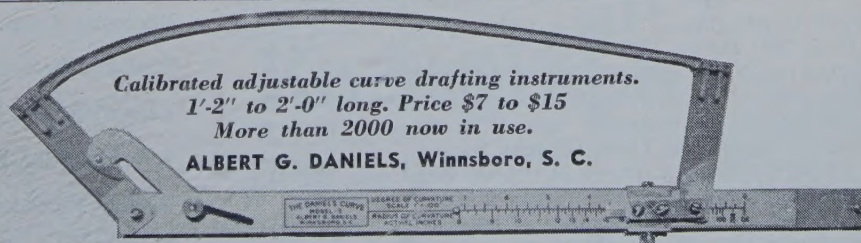
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## New Literature

**Discussion of Automotive Body Drafting Standards 1960** (SP-176) and actual standards, ready for insertion in the Automotive Drafting Standards Manual, have been published by the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y. Information regarding availability of these 1960 Standards may be requested from SAE.

**Microreproduction Filing System Brochure**, describing Microtape—100-foot rolls of 16mm or 35mm positive microtext printed from negative rolls and having a pressure-sensitive adhesive laminated to the reverse side—is offered by Microtape Systems, 44 Laura St., New Haven, Conn. For use, these rolls are cut into proper units and applied to an ordinary paper index card.

**Microfilm Camera Spec. Sheet** (No. F405, Rev. 1), presenting the Film-a-record Model 12, (Cat. No. F12), may be requested from Remington Rand, Div. of Sperry Rand Corp., 315 Park Avenue South, New York 10, N. Y. This is a large, all-purpose machine, designed for large-scale micro-filing with consistent accuracy and speed.

**Professional Lettering Catalog** (9591-9-10M) presents the latest type faces and accessories for Varigraph Lettering Instruments. An index of templates is provided and the alphabet of each is shown. Prices of templates are included. The Catalog may be requested from Varigraph Co., Madison 1, Wisconsin.

**Portable Drafting Equipment Brochure**, describing the Ames Draft-Pak, may be obtained by writing to The O. A. Olson Mfg. Co., 712 Tenth St., Ames, Iowa. The compact units are recommended both for students, and for professionals working at home or in the field. Draft-Pak includes tilt-up board with parallel plastic blade, and sectioned storage compartment. Prices are available separately.

**Precision Drafting Units Brochure** (P 105 E 21.8.59 Jd), describing Kuhlmann adjustable drawing tables for industrial drafting rooms, may be requested from Unitech Corp., 50 Colfax Ave., Clifton, N. J., distributors for Franz Kuhlmann, K. G. in the U. S. Standard Kuhlmann precision drafting machines are also described and illustrated. Price list may also be requested.

**Microfilm Aperture Card Filing Brochure**, tells the story of the part played by the Simplafind Automatic Filing Machine in the United States Army Signal Equipment Support Agency's (USASESA) "Collapse of Time and Space Program" at Ft. Monmouth, N. J. The brochure is available on request to Wheeldex & Simpla Products, Inc., 1000 N. Division St., Peekskill, N. Y., manufacturer.

**Transfer Papers and Films Brochure** (No. 21060-2), listing user applications and prices for diffusion transfer photocopy papers and films may be obtained from Ampto, Inc., Subs. of Anken Chemical & Film Corp., New York, N. J. Also briefly described are two photocopyers—the Ampto "Nine," for general office copying, and the Ampto "14," for the engineering department.

**Vertical and Roll File Equipment** is catalogued in AIA File 35-H-32 now available from Plan Hold Corp., South Gate, Calif. The 12-page publication is effectively illustrated, showing construction details of binders, racks, stands, files and cabinets, and their use in typical applications. An illustrated price list is also included.

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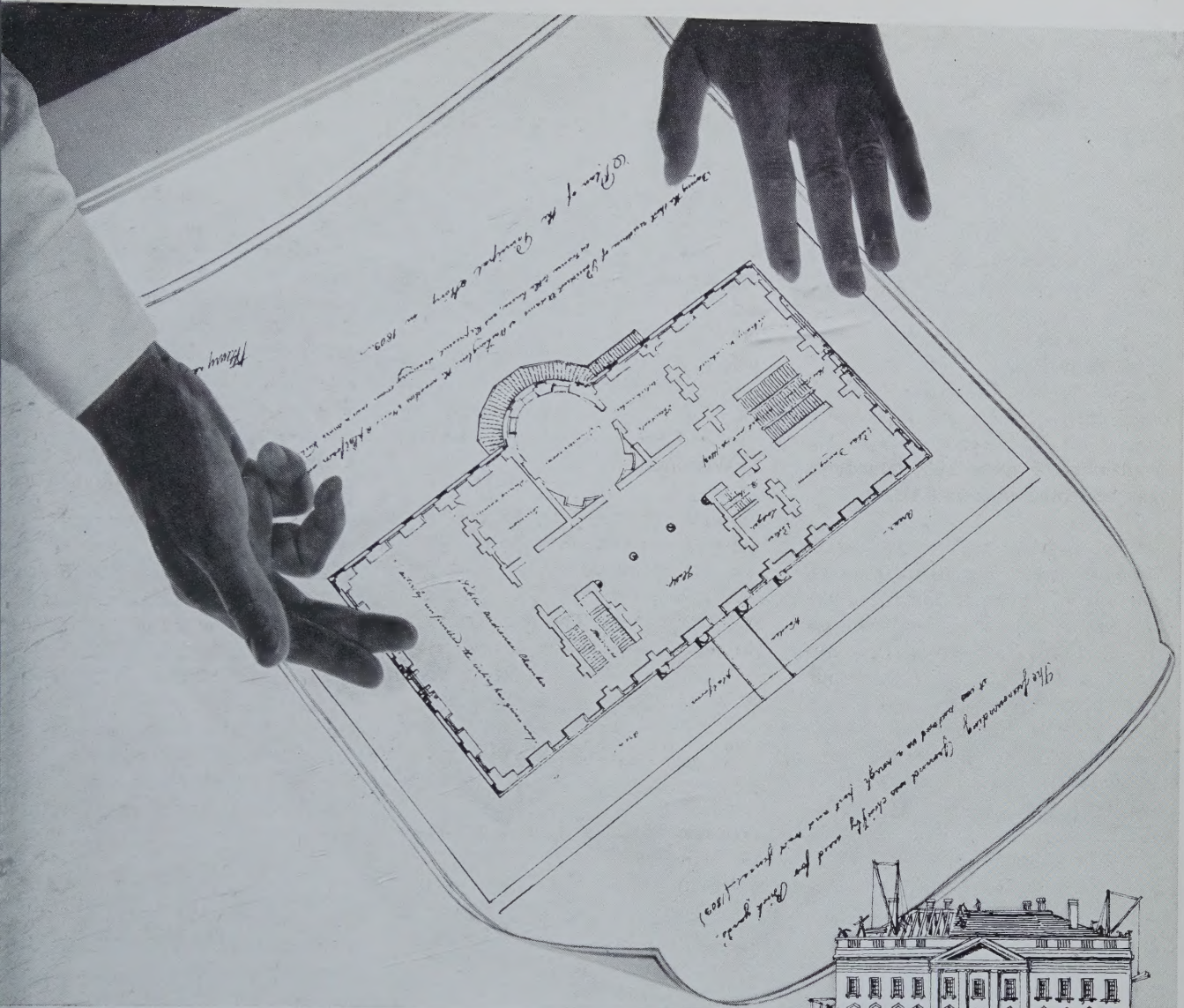
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Floor plan of the White House drawn in 1803 reproduced on new Kodagraph Contact Film, Estar Base. Original drawing in Library of Congress.

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